Method of making an annulus for a planet gear carrier

Field of the invention

The invention concerns a method of making a rotationally symmetric body, particularly an annulus for a planet gear carrier, said annulus comprising a tooth profile and/or additional elements, and said method being a non-cutting shaping method.

Background of the invention

It is common knowledge to make such rotationally symmetric bodies like annuli by turning and milling a blank, that may also be a forged blank.

However, due to their complex and work-intensive fabrication, rotationally symmetric bodies of the pre-cited type are very expensive.

It is further known, for example from EP-0 639 4135 A2, to make a rotationally symmetric body without chip removal from a blank by cold forming by drawing or deep drawing and ironing, as also by flow turning. As can be seen particularly in Figs. 1 to 11, such a manufacturing method requires a large number of manufacturing steps that, likewise, are still too cost-intensive. Furthermore, this fabrication method is only suitable for rotationally symmetric bodies comprising at least one radially oriented web region out of which cylindrical regions can be integrally formed without machining.

Object of the invention

The object of the invention is therefore to propose a method of making a rotationally symmetric body, particularly an annulus for a planet gear carrier, that is based on shaping without chip removal and thus eliminates the aforesaid drawbacks and permits an economic fabrication.

Summary of the invention

The invention achieves the above object by a method comprising: working the tooth profile and/or the additional elements into a sheet metal strip, cutting the sheet metal strip into desired lengths before or after working in the tooth profile and/or the additional elements, bending round the sheet metal strip to form a rotationally symmetric body and fixing the ends of the sheet metal strip to each other.

It is possible in this way to fabricate rotationally symmetric bodies, particularly annular bodies such as an annulus using non-cutting shaping procedures.

Further features of the invention form the subject matter of sub-claims 2 to 8.

Advantageously, the tooth profile and/or the additional elements are made without chip removal by rolling, stamping or forming. These are low-cost fabrication methods that, at the same time, provide adequate precision.

It is proposed in this connection to design the rolling, stamping or forming tool so that, after the bending of the sheet metal strip, the tooth profile and/or the additional elements have the desired profile shape and/or the additional elements are in the intended position. Depending on whether the tooth profile is subsequently arranged on the inner or on the outer wall, the flanks must have a larger or a smaller inclination on the straight sheet metal strip during manufacture.

The ends of the sheet metal strip can be joined to each other by welding.

However, it is also possible to form mating elements integrally on the ends of the sheet metal strip and to insert the elements into each other during and/or after the bending step.

Advantageously, the elements are configured as hook-shaped and/or T-shaped projections on one end of the sheet metal strip and as corresponding recesses on the other end (clinch connection). This results in a connection of the ends to each other that guarantees a good, stable connection of the ends relative to each other both in tangential direction as well as in a direction parallel to the central axis of the rotationally symmetric body. Depending on the field of use of the rotationally symmetric body, such a clinch connection is adequate. It can also be realized in an economic manner because it can be made at the same time as the stamping or shaping of the sheet metal strip or when cutting this into desired lengths.

Depending on the field of use of the rotationally symmetric body and the precision requirements, the ends of the sheet metal strip, even if a clinch connection is provided, can be additionally welded together, for example in the intermediate spaces of the hook-shaped and/or T-shaped projections and the corresponding recesses.

It is naturally also possible to provide two weld seams, one, as already described, in the intermediate spaces and the other on the ends of the hook-shaped and/or T-shaped projections and the respective bottom of the recesses.

The additional elements may be projections or recesses provided on the sides of the sheet metal strip that, in the finished state of the annulus, are oriented, for example, parallel to the central axis. With the help of these projections and recesses, such an annulus can be located or fixed on a further component, for example, a planet gear carrier.

Brief description of the drawings

For a further explanation of the invention, reference is made to the drawings in which one example of embodiment of the invention is shown in simplified illustrations. The drawings show:

Fig. 1, a perspective view of a finished annulus manufactured according to the method of the invention, for a planet gear carrier,

Fig. 2, a detail of a larger sheet metal strip comprising a worked-in tooth profile and additional elements, in a side view, and

Fig. 3, a perspective illustration of a sheet metal strip corresponding to Fig. 2.

Detailed description of the drawings

In Figs. 1 to 3, an annulus of a planet gear carrier where shown, is identified at 1 and comprises a tooth profile 2 on its inner side. The tooth profile is configured as a helical gearing. The annulus further comprises additional elements 3 in the form of projections and recesses on one side. With the help of these additional elements, the annulus can be located or fixed on another machine element such as a planet gear carrier and the like. This enables the transmission of any desired torsional forces.

The annulus 1 according to Fig. 1 is made out of a sheet metal strip 4. This sheet metal strip 4 can be endless stock material into which the tooth profile 2 and the additional elements 3 are worked in by rolling, stamping, and/or forming. The required length of the sheet metal strip 4 can then be cut off. However, it is also

possible to separate desired lengths from the sheet metal strip beforehand and form the tooth profile and the additional elements in these cut-off lengths.

After bending of the appropriately cut-off lengths of the sheet metal strip into a circular shape, the ends can be welded together so that a dimensionally stable annulus is formed.

List of reference numerals

1	Annulus
2	Tooth profile
3	Additional elements
4	Sheet metal strip